Specification Amendments Filed 03/08/05 with Response to Office Action mailed by Examiner on 09/08/2004 in Patent Application No. 10/068,433

The paragraph on Page 4 beginning with Line 5:

In certain embodiments, gratings **170** and/or **180** have a narrow bandwidth to define the precise position of the wavelength $\lambda_{s2'}$ within the allowed bandwidth of the second Raman Stoke shift. In some embodiments, at the wavelength $\lambda_{s2'}$ Bragg grating **180** has a high reflectivity (e.g., about 100%), whereas grating **170** has a lower reflectivity (e.g., less than about 100%). Energy at wavelength $\lambda_{s2'}$ can circulate in fiber **140** by reflecting between gratings **170** and **180**. In some embodiments, WDM **130** is designed so that substantially no energy at wavelengths λ_{s1} and $\lambda_{s2'}$ is transferred from fiber **140** to fiber **120**. In these embodiments, energy at wavelengths λ_{s1} and $\lambda_{s2'}$ can repeatedly propagate in fiber **140** in both the clockwise and counter clockwise directions, thereby enhancing the intensity energy at λ_{s1} and ~~λ_{s2}'~~ $\lambda_{s2'}$ within fiber **140**.

The paragraph on Page 4 beginning with Line 29:

In some embodiments, such as, for example, when grating **180** has a high (e.g., about 100%) reflectivity, the energy at $\lambda_{s2'}$ transferred from fiber **140** to fiber **192** through the WDM **190** is predominantly in a direction shown by the arrow in Fig. 1. In embodiments in which grating **180** does not have a high (e.g., about 100%) reflectivity there can be energy transfer from fiber **140** to fiber **192** at $\lambda_{s2'}$ in the opposite direction via WDM **190**. In these embodiments, energy at $\lambda_{s2'}$ is transferred from fiber ~~**120**~~ **140** to fiber **192** via WDM **190** in both directions. Fiber **192** optionally includes a fiber Bragg grating **194** designed to substantially reflect energy at wavelength $\lambda_{s2'}$, thereby allowing the majority of the energy at $\lambda_{s2'}$ transferred to fiber **192** from fiber **140** to ultimately propagate through fiber **192** in one direction.

The paragraph on Page 6 beginning with Line 1:

In certain embodiments, the path of pump energy propagation is as follows. After passing device **160**, pump energy λ_p propagates through fiber **120** until it encounters WDM **130**, then at least a portion of the pump energy is transferred to loop-shaped fiber **140** and propagates therethrough in the clockwise direction. When the pump energy reaches WDM **130** it can be transferred to fiber **120** and propagate ~~to~~ toward WDM **135**. WDM **135** transfers at least a portion of the pump energy from fiber **120** to loop-shaped fiber **145**, where the pump energy propagates in the clockwise direction. The pump energy can be transferred from fiber **145** to fiber **120** via WDM **135** and propagate toward the grating **150**. Grating **150** substantially reflects the pump energy, resulting in propagation of the pump energy in the opposite direction. This also results in counter clockwise propagation of the pump energy in fibers **145** and ~~**135**~~ **140**. The residual pump energy that is not converted into Raman shifted signals can be terminated (e.g., removed from system **200**) via device **160**.

The paragraph on Page 8 beginning with Line 12:

Fig. 4 shows a cascaded laser system **301**, including an optical circulator **162**, a fiber **312**, a WDM **362**, Bragg gratings **322** and **332**, a coupler **307** (e.g., a broadband coupler, such as a broadband 50% x 50% coupler), a loop-shaped fiber with Raman active material **317**, a fiber **366** and a terminal broadband reflector **152**. In certain embodiments, some or all of these elements can be similar to those described above with respect to system **300**. In some embodiments, the optical circulators can be used as follows. Circulator **160** directs pump energy into the first Raman cascade and then it redirects the backward propagated energy toward the optical circulator **162**. Optical circulator **162** directs pump energy into the second Raman cascade and then redirects the backward propagated pump energy into optical ~~bass~~ bath for disposal or it can direct it to the next cascade. The number of cascades can be more than two. Each cascade can generate its own wavelength λ_{s2}, (e.g., the first cascade - $\lambda_{s2'}$, the second - $\lambda_{s2''}$ etc.). Energy at these wavelengths can be transferred via the respective WDMs **360, 362** etc. The WDMs can be connected with the common fiber **390** and provide the combined set

of wavelengths $\lambda_{s2'}$, $\lambda_{s2''}$ etc. at its terminal end. Intensities of energy at the latter wavelengths can be regulated via coupling efficiencies of the output couplers.

The paragraph on Page 8 beginning with Line 27:

Fig. 5 is a schematic view of a Raman fiber laser system **400** including an energy source **110** and a fiber **120**. ~~Fiber~~ System **400** includes pairs of fiber Bragg gratings (**410/415, 420/425, 430/435, 440/445, 450/455**) and a Bragg grating **150**, which has a high (e.g., about 100%) reflectivity at the pump wavelength λ_p. The fiber Bragg gratings within any particular pair can substantially reflect energy at the same wavelength. For example, gratings **410** and **415** can substantially reflect energy propagating in fiber **120** at the first order Raman Stoke shift λ_{s1}. Certain pairs of gratings (e.g., **430/435**) are arranged so that there are no dissimilar gratings therebetween. With this arrangement, energy propagating in fiber **120** at the wavelength reflected by these gratings is confined to the region in fiber **120** between the gratings (e.g., **430/435**). If desired, a coupler can be included in system **400** so that energy at this wavelength can be transferred from fiber **120** (e.g., to an optical fiber for pumping).

The paragraph on Page 10 beginning with Line 10:

~~Fig~~ Fig. 6 shows a schematic of system **500**. The tandem grating pairs (**420/425, 430/435, 440/445, 450/455**) can all have, for example, a high (e.g., about 100%) reflectivity at certain wavelengths (e.g., $\lambda_{s2'}$, $\lambda_{s2''}$, ~~$\lambda_{s2''}$, $\lambda_{s2''}$;~~ $\lambda_{s2'''}$, $\lambda_{s2''''}$). Energy transfer at wavelengths $\lambda_{s2'}$, $\lambda_{s2''}$, $\lambda_{s2'''}$, $\lambda_{s2''''}$ is conducted via WDM **424, 434, 444, 454**, respectively, disposed between corresponding gratings and connected with fiber **180**. The coupling efficiencies of the WDMs can be substantially less than 100% and can be appropriately set to obtain a predefined intensity distribution of output energies at the wavelengths $\lambda_{s2'}$, $\lambda_{s2''}$, $\lambda_{s2'''}$, $\lambda_{s2''''}$.(e.g., a substantially flat intensity distribution at these wavelengths). In some embodiments, one of the terminals of fiber **180** can optionally have reflector **470** and/or reflectors **472, 474, 476** that would facilitate the delivery of output energy to the right side terminal of the fiber **180**. In certain embodiments, system **500** can have two

output ports for energy at wavelengths $\lambda_{s2'}$, $\lambda_{s2''}$, $\lambda_{s2'''}$, $\lambda_{s2''''}$ through the left and right terminals of fiber **180**.